MACHINE LEARNING TO EXPLOIT LIGO/VIRGO SINGLE-DETECTOR DATA TAKING PERIODS

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Despite the breakthrough discoveries of multiple gravitational wave events made by the LIGO and Virgo detectors, the exploitation of the gravitational-wave data is still limited by the non-Gaussian transient noises that contaminate the data and mimic the astrophysical signal. Typically, the request that the triggers are in temporal coincidence in two or more detectors is enough to avoid the contamination by these "instrumental glitches". However, in this way the data collected when only a single detector is operating are not completely assessed. This fraction of data, corresponding to about 30% of the observation time, could hide new events and important discoveries. For O1 and O2, the single-detector time corresponds to almost three months of data. It can be estimated that, statistically, three events are expected in this period. In the next LIGO-Virgo data takings, the problem will be repeated. In order to analyse the data taken by a single detector, an original method to separate the glitches from the astrophysical signal is required. This is a very challenging task, since glitches vary widely in duration, frequency range and morphology. The glitches complex and time-evolving nature make their identification and reduction an ideal case to apply machine learning, and in particular deep learning, algorithms.
The first results of the use deep learning algorithms to study, identify and reduce the transient noise present in the gravitational wave detectors during single-detector data taking periods will be shown.